CLAIMS

[c1] 1. A communication station for acquiring an access probe signal transmitted by a beam source corresponding to a range of frequency and timing uncertainty of the access probe signal arrival, the communication station comprising:

a plurality of receiver means, each receiver means searching for the access probe signal within an assigned search space to resolve the frequency and timing uncertainty; and

means for assigning a search space to the plurality of receiver means, each search space corresponding to one of the plurality of beams from the beam source and each beam corresponding to a reduced range of frequency and timing uncertainty of the access probe signal arrival.

[c2] 2. The communication station of claim 1, wherein the beam source is a satellite.

[c3] 3. The communication station of claim 2, wherein the satellite is a low earth orbit satellite.

[c4] 4. The communication station of claim 2, wherein the access probe signal is from a user terminal and is relayed by the satellite to the communication station, and wherein the time uncertainty corresponding to each beam is defined by maximum and minimum distances between the user terminal and the satellite within a coverage region of each beam.

[c5] 5. The communication station of claim 2, wherein the access probe signal is from a user terminal and is relayed by the satellite to the communication station, and wherein the frequency uncertainty corresponding to each beam is defined by a range of azimuths and a range of elevations containing a nominal coverage region of each beam.

[c6] 6. The communication station of claim 1, wherein the beam source is a base station.

[c7] 7. The communication station of claim 1, wherein the access probe signal comprises a preamble and a message portion.

[c8] 8. The communication station of claim 7, wherein each receiver means comprises:

means for performing a coarse search to resolve the frequency uncertainty of the access probe signal; and

means for performing a fine search to resolve the timing uncertainty of the access probe signal.

[c9] 9. The communication station of claim 8, wherein the means for performing a coarse search comprises means for performing, in serial, a search in frequency over the assigned search space.

[c10] 10. The communication station of claim 8, wherein the means for performing the coarse search comprises means for performing, in parallel, a search in time over the assigned search space.

[c11] 11. The communication station of claim 7, wherein each receiver means comprises:

a means for correlating the access probe signal with various frequency and timing hypothesis pairs defined within the assigned space;

means for determining a highest correlation to resolve the frequency and timing uncertainty by setting a hypothesis pair corresponding to the highest correlation as an arrival frequency and timing of the access probe signal; and

means for demodulating the message portion based on a result of resolving the arrival frequency and timing uncertainty.

[c12] 12. A gateway comprising:

a plurality of receiver means, each receiver means searching for a access probe signal within an assigned search space to resolve a frequency and timing uncertainty of the access probe signal arrival; and

means for assigning a search space to the plurality of receiver means, each search space corresponding to one of the plurality of beams from a satellite corresponding to a range of frequency and timing uncertainty of the access probe signal arrival, and each beam corresponding to a reduced range of frequency and timing uncertainty of the access probe signal arrival.

[c13] 13. The gateway of claim 12, wherein the satellite is a low earth orbit satellite.

[c14] 14. The gateway of claim 12, wherein the access probe signal is from a user terminal and is relayed by the satellite to the gateway, and wherein the time uncertainty corresponding to each beam is defined by a maximum and minimum distances between the user terminal and the satellite within a coverage region of each beam.

[c15] 15. The gateway of claim 12, wherein the access probe signal is from a user terminal and is relayed by the satellite to the gateway, and wherein the frequency uncertainty corresponding to each beam is defined by a range of azimuths and a range of elevations containing a nominal coverage region of each beam.

[c16] 16. The gateway of claim 12, wherein the access probe signal comprises a preamble and a message portion.

[c17] 17. The gateway of claim 16, wherein each receiver means comprises:

means for performing a coarse search to resolve the frequency uncertainty of the access probe signal; and

means for performing a fine search to resolve the timing uncertainty of the access probe signal.

[c18] 18. The gateway of claim 17, wherein the means for performing a coarse search comprises means for performing, in serial, a search in frequency over the assigned search space.

[c19] 19. The gateway of claim 17, wherein the means for performing the coarse

search comprises means for performing, in parallel, a search in time over the assigned search space.

[c20] 20. The gateway of claim 16, wherein each receiver means comprises:

a means for correlating the access probe signal with various frequency and timing hypothesis pairs defined within the assigned space;

means for determining a highest correlation to resolve the frequency and timing uncertainty by setting a hypothesis pair corresponding to the highest correlation as an arrival frequency and timing of the access probe signal; and

means for demodulating the message portion based on a result of resolving the arrival frequency and timing uncertainty.

[c21] 21. A communication station for acquiring a signal, the communication station having a coverage region corresponding to a range of arrival frequency and timing uncertainty of the signal, the communication station comprising:

a plurality of receiver means, each receiver means searching for the signal within an assigned search space to resolve the frequency and timing uncertainty; and

means for assigning a search space to the plurality of receiver means, each search space corresponding a coverage region corresponding to a reduced range of arrival frequency and timing uncertainty of the signal.

[c22] 22. The communication station of claim 21, wherein the signal is an access probe signal.

[c23] 23. A communication station for acquiring an access probe signal relayed by a beam source corresponding to a range of frequency and timing uncertainty of the access probe signal arrival, the communication station comprising:

a plurality of receiver means, each receiver means searching for the access probe signal within an assigned search space to resolve the frequency and timing uncertainty; and

means for assigning a search space to the plurality of receiver means, each search space corresponding to one of the plurality of beams from the beam source and each

beam corresponding to a reduced range of frequency and timing uncertainty of the access probe signal arrival.

[c24] 24. The communication station of claim 23, wherein the beam source is a satellite.